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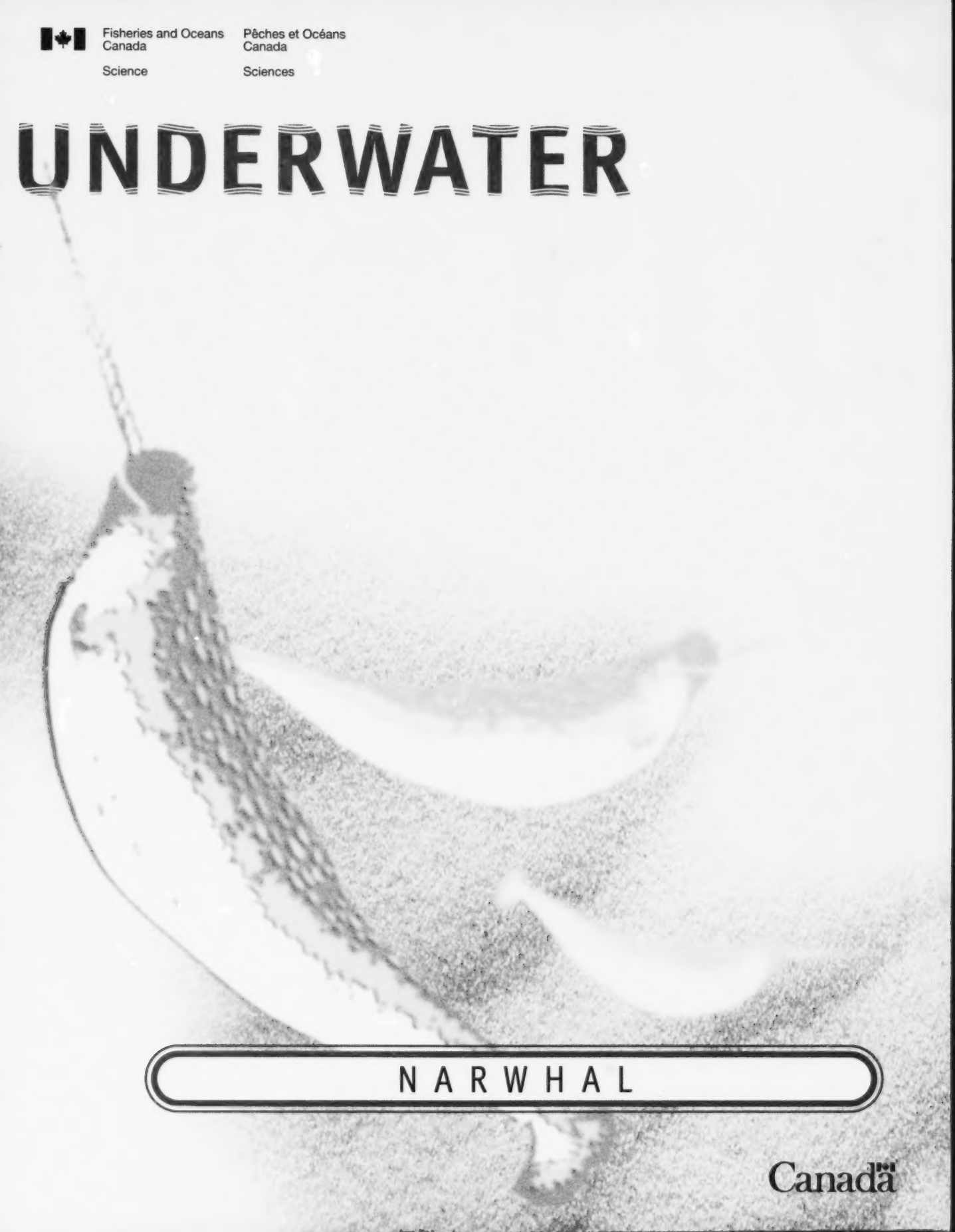

NARWHAL

Canada

THE NARWHAL: Unicorn of the Seas

The long straight tusk that rises into the sky when a narwhal raises its head at the water's surface is linked to the ancient legend of the unicorn.

Illustration by Ray Phillips, Winnipeg

Along the trade routes of Europe during the Middle Ages, thousands of the beautiful white tusks, which spiral to a tapered point, were sold as so-called unicorn horns or "alicorns". People traded gold and valuables for an "alicorn" they believed to have magical cure-all properties, when in fact the horn was the tooth of a whale, or cetacean, from Arctic seas.

The scientific name of the narwhal is *Monodon monoceros*. It belongs to the cetacean suborder odontoceti or "the toothed whales". The long tusk is a unique feature among odontocetes, which also include sperm whales, pilot whales, dolphins and porpoises. Although it is renowned for its single tusk, some male narwhals do in fact, have double tusks. The pallid and mottled colouring of the adult narwhal's skin and its summertime habit of logging, or lying inactive at or just below the surface, could be reasons for its common name from the Old Norse of nar (corpse) and hvalr (whale). Qilalugaq tugaalik is the Inuktitut name for the narwhal.

Distribution and Migration

The narwhal inhabits ice covered Arctic seas. Ice is important to its habitat, and affects the migration habits of the species. It navigates easily under the ice due to the lack of a dorsal fin. It can break through several centimetres of ice with its head or back, and can travel kilometres under the ice between breathing opportunities and even use the breathing holes made by Arctic seals. It rarely enters warmer waters, where it would encounter predatory killer whales and be in competition for food with whale species that are better adapted to temperate conditions.

Photo: Glenn Williams

Narwhals "tusking" - the whales are raising their tusks vertically above water. Note the prenounced melon.

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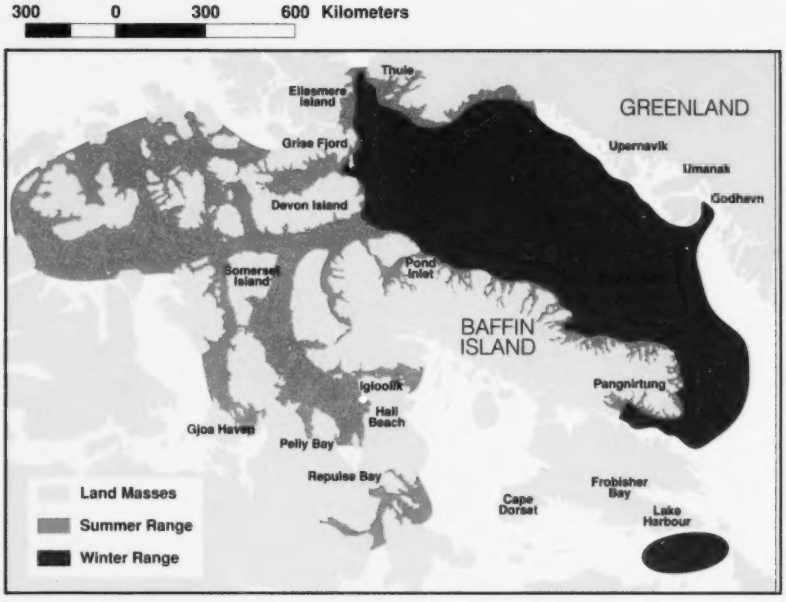

Range of narwhal populations.

In Canadian waters, most narwhals spend the winter in the pack ice of Baffin Bay and Davis Strait, between Baffin Island and Greenland. As the ice melts in spring, the whales migrate northward up the east coast of Baffin Island. Herds of hundreds of narwhals, heading north and west, round Bylot Island off the northern end of Baffin Island. They crowd at the edges of the fast ice in Pond Inlet, Lancaster Sound and Jones Sound. As these ice edges retreat with the onset of summer, narwhals follow the larger cracks in the ice. In summer, they aggregate along the coast of Baffin Island and in Eclipse Sound, Navy Board Inlet, Admiralty Inlet, Prince Regent Inlet and Peel Sound. Aerial surveys of this summering area estimate the total number of narwhals in this population to be between 60,000 and 80,000 animals.

During the summer, there are an additional 5,000 or so narwhals in northwest Hudson Bay. Scientists believe this population is separate from the population that summers in the Canadian High Arctic and from the population of whales that occupy west Greenland waters. It winters in Hudson Strait, while the other two populations winter in Baffin Bay and Davis Strait. Numbers of narwhals in the adjacent waters of west Greenland are not well known but probably number several thousand as well.

At the height of summer, narwhals are found in greatest numbers in the fjords of northern Baffin Island and in Prince Regent Inlet, moving from place to place in small groups or occasionally herds of a few hundreds. Narwhals or narwhal remains have been seen further north and west in summer. The whales seem to find safety in these areas in the same way as the ice provides a haven at other times of year. Indeed, the winter ice shelters narwhals from rough seas and predatory killer whales, a protection which they may seek during the open water season in these bays.

When the days shorten and seas start to freeze in September, narwhals head out again into Baffin Bay. Sometimes the herds are trapped in the forming ice as dozens or even hundreds crowd at a single breathing hole in the ice. Here they may become prey for polar bears or Inuit hunters.

The narwhal is also found in other parts of the Arctic: in the waters to the east of Greenland, and in the European Arctic but in lesser numbers. Although not unknown, the narwhal is uncommon in the Bering, Beaufort and Chukchi Seas, and in seas to the north of Siberia.

Biology and Behaviour

The lack of a dorsal fin may be an evolutionary adaptation as its smooth shape enables the whale to swim easily under ice. In addition, the neck vertebrae of the narwhal are not fused together, but are jointed, like those of land mammals. These characteristics are shared by the beluga whale, *Delphinapterus leucas*, a fellow inhabitant of icy Arctic seas. The two whales are classified in the same family, the Monodontidae, separate from other odontocetes. Recent biochemical studies have confirmed their close relationship.

Biology and Behaviour

The narwhal is considered large among the toothed whales. On average, males weigh about 1,600 kilograms and are about 4.7 metres long, while females weigh about 900 kilograms and are about 4.0 metres long. Narwhals have blunt heads and small mouths, and are sleeker compared to beluga whales which look more lumpy and blubbery. On small scale aerial photographs, narwhals can be distinguished from belugas by their lack of visible flippers and lack of squared shoulders. The caudal peduncle, or base of the tail, is quite fine and dark and therefore almost invisible. The tail is visibly different from the beluga. Narwhal tail flukes—the fins or flat "wings" of the whale's tail—are curved, and the extreme tips of the flukes are recurved, giving the tail an anchor-like shape.

Mature narwhals are mostly white, with a darker melon (the hemispherical body of fatty tissue on the whale's head) and a dark strip down the back. On either side of the strip, dark flecks and spots become sparser toward the flanks. The narwhal is insulated from the freezing waters of its habitat by a layer of blubber—fatty tissue under the skin—that can be up to 10 centimetres thick.

The most common external parasites are whale lice. A ring of louse infestation is always found in males around the base of the tusk, where it breaks through the lip. Whale lice are also found in patches where wounds have given them a foot hold, although many wounds heal without becoming infested. Small numbers of worms are found in the stomach, and worm infections of the middle ear are also common.

Narwhals have no functional teeth for feeding. Two elongated teeth develop in the upper jaw, but they point forwards, not downwards into the mouth. In females, both teeth usually remain embedded in the jaw bone, growing no longer than 15 centimetres. In males, and a very few females, the left tooth erupts through the lip and develops as a straight, spiral, tapered tusk. In males, the tusk reaches 2.0 to 2.5 metres in length, twisting to the left as it grows. Some males also grow a tusk on the right side as well, usually shorter than the left.

It is uncertain if a narwhal tusk is only present to signal a male narwhal's sexual maturity or if it serves other purposes. It has been suggested that the narwhal may use it to spear fish, to stir up the bottom of the ocean, to break ice, as a wave guide for its underwater vocalizations, to prop itself up on ice floes to go to sleep, and as a sensor for prey or salinity detection. The tusk may also be used as a weapon by the males in fighting for access to females. However, most females have no tusk, suggesting that it is not essential for survival. The tusk may also be used as a weapon by the males in fighting for access to females.

Unfortunately, mating takes place in spring when narwhals are in the offshore pack ice, so this hypothesized male competition during mating has not been observed, but there are scars on the foreheads of mature males that support the theory for this use. During summer, males have been seen lifting their tusks out of the water and crossing them with the tusks of one or two other males. It is unknown if this "tusking" has to do with establishing social dominance, or is just a summertime male narwhal behaviour. There is at least one known instance where a tusk was used against another species. The broken tip of a narwhal tusk was found embedded in the melon of a beluga. This suggests that there was an aggressive encounter

Photo: Larry Dueck, DFO

A group of younger males. The leading one is a dark sub adult. Note the neck articulation shown by the upper one.

between the two species and reinforces the notion that tusks are occasionally used by males to attack adversaries.

It is believed that females start bearing calves at six to eight years of age. Adult narwhals mate in April or May, and gestate for 14 months, bearing their calves between June and August of the following year. Like most marine mammals, narwhals have only one calf at a time. While the newborn calves have only a very thin layer of blubber, the mother's milk is rich in fat and a thicker blubber layer soon develops in the calves. The newborn calves, averaging 1.6 metres in length, are dark grey. As a narwhal matures, white patches appear on the underside of the whale and spread to its sides and back.

Calves are nursed about 20 months. The lengthy lactation period provides calves with time to learn the skills they need to survive. Mother and calf are usually close, and when the whales are travelling, the calf remains close to the mother's back, where it may get assistance in swimming. It is easy to spot the baby in a traveling group of whales, as the little grey head moves up to breathe with a jerky bob, quite unlike the smooth movement of an adult.

Ecology

The species is well suited to deep sea diving with its well-developed oxygen-holding capacities in blood and muscle tissue, even for a whale, combined with a complex network of blood vessels between the lungs and the spine. Because the narwhal has no functional teeth, but has a wide rostrum (upper jaw) and a ridged palate, anatomy experts hypothesized that the whale may live mostly on a squid species which is found at depths ranging down to several thousand metres. Spring and summer examinations of the contents of narwhal stomachs show that they contained squid beaks, but they also indicate that a large portion of the narwhal's diet comes from turbot, also known as Greenland halibut. Narwhals have been measured diving to depths of at least 1500 m and are probably capable of diving deeper. Turbot are found at depths between 300 and 1600 metres. A *Pandalus* shrimp species is also found in the stomachs of narwhals. This shrimp is also found at depths down to 1200 m. At the ice edge in spring, and in channels and bays in summer and autumn, narwhals feed heavily on arctic and polar cods, small relatives of the familiar food fish.

There is no concrete information on how much narwhals eat in the wild, but a whale of such size should need about 30 kilograms (wet weight) of food each day to

live. While some have suggested that narwhals eat less in the summer and lose some weight at that time, these whales have been observed in August engaged in deep-diving behaviour typical of feeding, and summer blubber loss is only slight. They do not seem to hunt cooperatively for prey.

Between deep-feeding dives, narwhals lie still in the water breathing deeply to replenish their oxygen stores. As the whale breathes in, the long grey back rises in the water, and then the blowhole is closed for a while, before an explosive exhalation and the next indrawn breath. When it has finished ventilating, it starts to swim forward, rising and falling in the water with increasing amplitude as it accelerates. The last high rise in the water, in which the head is often thrown almost clear, is followed by a deep dive. The body and tail stock are highly flexed at this point, as the whale submerges. Narwhals often, but not always, "fluke out" (raise their tail) when starting a deep dive.

In general, this whale is a placid species, not often given to spontaneous exuberance. It has a slow swimming speed and, although it is generally a social species, few individual behaviour patterns have been recorded. The usual social unit is a group of two to 12. Groups often consist only of adult males, or only of sub-adults and females with young, but mixed groups can also occur. There is no information on how long these groups last, of if they have any enduring social bonds. When travelling, these groups may be tight together and the individuals often seem to be almost touching. There appears to be little vocalization. There seems to be more noise when the group travels in a less dense formation, when a series of 'clicks' and trumpeting can be heard. Summertime is a lazy time for the narwhals, as they often seem to be loafing, logging (lying inactive at or below the surface), and socialising. A wide variety of behaviour patterns have been observed and recorded. Males in particular, display to each other, crossing and perhaps "comparing" their tusks. However, there is no information on the social significance of these behaviour patterns or on the way narwhal society is structured.

The natural death rate among adults is probably quite low—only a few per cent per year—and the mortality of the young is unknown. Their slow reproduction means that narwhal populations would recover very slowly if their numbers were substantially reduced.

Sound, Communication and Hearing

While it is hard to see for great distances in the ocean, sound travels well. Narwhals, like other toothed whales, have evolved complex and sophisticated systems using sound to investigate their environment and to find food.

The narwhal can create 'click' and 'whistle' sounds, probably by controlling passage of air between chambers near the blowhole, as is know to be done in other odontocete species. These sounds may then be reflected off the sloping front of the skull. The sounds may then be further focused by the melon, the round space on the head filled with a special mix of blubber oils, and can be altered in shape under muscular control. Clicks and 'knock' sounds can come slowly, like knocks on a door. Faster sequences sound like a stick on a picket fence, and can also come in very rapid succession, producing a kind of trumpet blare or the sound of a squeaking door.

The so-called "click trains" are used by toothed whales for echo-location of prey, and for detecting obstacles at short ranges. It has been suggested that individual 'bangs' could be strong enough to disorient or incapacitate prey, making the prey easier to catch, but that idea has not been verified. Whistles are rarely heard—another contrast with the beluga with its nickname "sea canary" because it whistles so much. Trumpetings, whistles, and squeaking door sounds may also be used for communication among nawhals.

Photo: Jack Orr, DFO

Inuit hunters have landed a "qilalugaq tugaalik" - the Inuit name for a tusked narwhal. Inuit eat the whale's "Maqtaq" - the nutritious top layer of skin and blubber that is an Arctic delicacy.

Males appear to have a larger vocal repertoire than females, making a wide range of calls when socializing.

Management and Conservation

Narwhals are hunted by the Inuit of the Canadian Arctic and in Greenland. The vitamin C-rich skin, known as "maqtaq", is a valued food and eaten raw or boiled, especially the narrow strips taken from the back edges of the tail and flippers. The meat is often left to age through the summer and fall, to be eaten cured in winter.

The tusks command a high price on international markets. Narwhal, like other toothed whales, is listed in Appendix II of the Convention on International Trade in Endangered Species (CITES), so trade in tusks requires an export permit. Tusks sold on the market in Canada must have special tags attached to indicate they were obtained legally in the course of an Inuit hunt. Measures and assessments such as these are designed to ensure narwhal hunts in northern Canada are sustainable, however, concern for the species has led the European Economic Community to ban the import of tusks into member states (tusks taken by the Inuit of Greenland are exempt).

Inuk villages where narwhals occur have had kill quotas. These range from over a 100 in Arctic Bay and Pond Inlet in north Baffin Island where narwhals come in great numbers every year, to five for communities away from the zone of greatest abundance. This system is now being changed to a community-based management system that emphasizes local bylaws on hunting. It aims to re-establish ethical codes of conduct and apprenticeship from elders, and to reduce hunting losses. Tags authorizing a hunter to take a whale are distributed by local Hunters and Trappers Associations, and hunters are expected to follow the local bylaws. The estimated landed number of narwhals in Canada in recent years has varied between 400 and 600 per year.

Current Research

One area of recent research on the narwhal has focused on finding a reliable way to determine the age of individuals, so that there is more and better information on population dynamics.

Layers in teeth are often used to age animals. Although a narwhal's embedded tooth does have layers, they can become indistinguishable after a certain point in the animal's physical development. Tusks have readable layers, but sawing a tusk in half is not only an expensive way to age a narwhal, it is also only effective on males. Scientists have looked for layers that may be related to age in other hard structures, such as bones, and have examined age related changes in the amino acid composition of the tip of the embedded tooth and the eye lens. The latter has recently produced some interesting results, which suggest that scientists may have underestimated the age of narwhals.

The movements of narwhal live-captured in their summering areas near Eclipse Sound, in Admiralty Inlet and in Prince Regent Inlet have recently been studied using radios mounted to the whale's tusk or back. The radios transmit signals to orbiting satellites. As well as yielding information on movements of the whales in their summering areas, the "satellite-tagging" also allows tracking in the dark months of the Arctic winter. Tags, capable of storing and transmitting information on how deep and how often a narwhal dives, have already provided valuable information on underwater behaviour.

A challenge for future years will be to estimate the size of the entire population of narwhals in Canada and monitor trends in numbers—a difficult task since the population is both widespread and deep-diving. Current estimates which focus on aggregation areas provide only indications of population size, and are probably low in comparison to true population size.

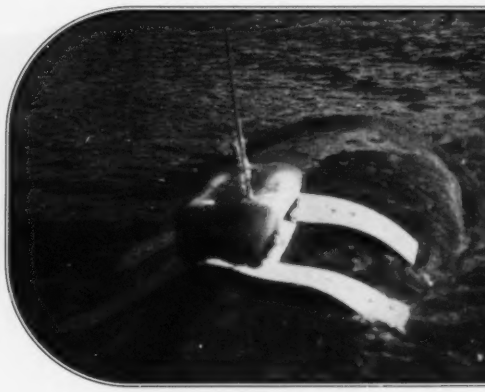

Photo: Rune Deitz, NERI-Denmark

The movements and behaviour of narwhal have been studied using radio transmitters that send signals to polar-orbiting satellites.

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Further Reading

Note: Most of these articles can be found in the local college or university library. Despite their usefulness as general sources of information on narwhals, several of these references may not reflect recently published information given in this report, particularly with respect to new narwhal population estimates, range extensions and some aspects of their ecology. Notes indicate changes next to some of the references.

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